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Research Briefs

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Nutrition and Health

A low-fat diet that included poultry, fish, lean beef and pork, dairy products and eggs lowered blood pressure and cholesterol levels in a study of 12 men, ages 35 to 65. After 6 weeks, their blood pressure was lowered an average of 10 percent, and cholesterol levels an average of 20 percent. In the low-fat meals, fat supplied only 25 percent of the day's total calories. Among the servings were about 4 ounces of lean meats, low-fat cheeses, skim milk and margarine. The recent study was one of a series on the role of nutrition in lowering risk of heart disease.

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Women don't have to be anemic to have tired blood. A recent study found that women have less energy available during a workout and tire faster when their iron stores are low. After 11 healthy young women consumed a low-iron diet for three months, they used less oxygen during hard exercise, burned fewer calories and accumulated considerably more lactate, which causes that "lead in the legs" feeling. According to their hemoglobin and hematocrit levels—two measures of iron associated with red blood cells—the women were in the low-normal range for iron after the low-iron diet. But their indicator of stored iron—

serum ferritin—had dropped dramatically to one-fifth the starting level. As exercise progresses, the body normally switches from burning all glucose (anaerobic exercise) to burning a mixture of glucose and fat (aerobic exercise). But it takes more oxygen to burn fat, so the women continued to burn mostly glucose. And that's not as fuel efficient.

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Building more bone during the formative years is the best insurance against osteoporosis later in life. Studies with aged female rats show that neither extra calcium—above the recommended amount—nor the activated form of vitamin D reduces bone loss in the aging. In one study, a diet containing nearly twice the recommended calcium intake (for rats) did not affect the rate of bone turnover in 2-year-old female rats but increased bone formation in young female rats. In another study, the use of activated vitamin D (the hormonal form) to preserve skeletal integrity was compared in two groups of old rats—those with no ovaries and others with intact ovaries. The activated vitamin improved bone mineral content in the rats with intact ovaries but did not prevent bone loss in the group without ovaries, indicating that ovarian hormones are critical in bone metabolism. The active form of vitamin D has been tested as a treatment for osteoporosis in the past, but its use has become controversial because one of its functions is to demineralize bone.

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Remember how cod-liver oil made you gag? Animal studies are now showing that fish oil may actually prevent loss of appetite during an inflammatory illness or injury. In a series of studies with rats, scientists found what causes people with chronic infections or cancer to lose appetite and thus weight. A substance secreted by activated immune cells apparently boosts production of prostaglandin E₂—a hormonelike chemical—which caused the rats to eat less. However, when the animals were fed fish oil for several weeks before being injected with the immune cell substance (interleukin-1), the oil reduced their production of E₂ and maintained their food intake. If substantiated in human studies planned at the University of California, fish

oil supplements would be a simple and safe intervention for patients experiencing, or expected to experience, loss of appetite and weight.

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Can a person be overweight—and not be fat? Determining obesity with weight-to-height tables was found to be about as accurate as skinfold measurements—and that's not very accurate. For example, muscular athletes such as weight lifters could easily score overweight despite their low body fat. Searching for a simple yet accurate way to predict obesity and its related diseases, scientists compared the weight-height tables with standard methods for estimating body fat content in 593 men and women. About 30 percent of those rated "overweight" based on the tables were in the normal range for body fat levels. And 11 percent of the women and 18 percent of the men who scored "obese" didn't have excessive body fat. A problem is that scientists have not yet defined obesity as it relates to disease: Is it overweight or, as some recent studies indicate, overfat or where fat is located on the body? While science grapples with that question, ARS researchers are looking for a body measurement, such as waist or hip girth, that can be plugged into weight-height indices to give health and fitness practitioners a more accurate estimate.

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Runners, cyclists and other very active men need about 60 percent more protein than current dietary recommendations, a study shows. But there's little reason for concern because all western diets supply more than enough protein, even vegetarian diets that include milk and eggs. This is the first study to show that physically active men, both young and middle-aged, need more protein than sedentary men. The current U.S. and World Health Organization recommended daily protein intake—0.8 gram per kilogram of body weight—is based on studies of sedentary men and was not thought to differ for active men. Based on the 12 very active men in this study—half in their twenties and half in their fifties—an average of 1.25 g, or about 60 percent more protein, would be the recommended intake for athletes. According to USDA food consumption data, men in this age range already average at least 70 percent more protein than the Recommended Dietary Allowance. Only athletes who continually diet, such as dancers, gymnasts and wrestlers, may be getting less protein than they need.

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Linseed oil from flax might help the immune system fight infection, if results from a study of rabbits prove true for humans. In a 5-month study, rabbits ate feed rich in either linseed, safflower, soybean or menhaden (fish) oil. Compared to the other three oils, linseed proved the best in three tests of how the immune system responds to attack, including one that measures the increase in infection-fighting white blood cells in culture dishes. A study with human volunteers is planned for 1989. But researchers caution people against treating themselves with linseed oil; in the United States, it's made into industrial products and has not been approved by the Food and Drug Administration for human consumption.

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Should mothers who depend on insulin to control juvenile (type I) diabetes nurse their infants? Preliminary findings suggest there's no reason not to—if the infant is healthy and the mother feels good. Analyses of the breast milk from five insulin-dependent mothers found almost no difference in levels of protein, carbohydrate, fat, energy and essential minerals compared with the milk of nondiabetic mothers. And there was no difference in immune factors. Only glucose and sodium were significantly elevated in the diabetics' milk but not enough to affect the infant.

Children's Nutrition Research Center Houston, TX

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Some citrus fruits contain a chemical that may help prevent cancer, if results from a study of mice prove true for humans. A University of Minnesota researcher, collaborating with an ARS scientist, found that nomilin—a compound that causes bitterness in some citrus juices—helped prevent cancerous tumors from forming in the stomachs of 28 percent of the mice fed a potent carcinogen. Apparently, nomilin can more than triple the normal activity of an important detoxifying enzyme, glutathione S-transferase. More research is needed to find out if nomilin and the nomilin-derived compounds, known as nomilin glucosides, have anticarcinogenic effects in humans.

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Tomorrow's Foods

Fruit that tastes like a baked cinnamon apple dessert? Yes. Southern Florida's sugar apple and its relative, the atemoya, may become new additions to supermarket produce sections throughout the country. These tropical fruits have had limited market potential because of their perishability. Scientists are evaluating sugar apple seedlings from Brazil in hopes of improving the fruit's 3- to 4-day shelf life. The atemoya—produced from the sugar apple and a related species, the cherimola—is even more promising. Hybrids produced from the sugar apple and cherimoyas from Australia and Israel may increase shelf life up to 10 to 14 days.

Subtropical Horticulture Research, Miami, FL

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Keeping with the consumer trend toward "natural" food products, researchers are working on a new, 100-percent fruit juice drink. The drink, a blend of passion fruit and orange juices, scored better with taste test panels when the amount of orange juice exceeded the amount of passion fruit juice. Passion fruit has a full-bodied, tangy flavor that tends to be more popular when mixed with another juice. Abundant in Australia and Brazil, passion fruit is rarely consumed as a fresh fruit because of its many seeds. Researchers plan other all-natural tropical fruit juice blends, including ones with mango, for the health-conscious consumer.

Citrus and Subtropical Products Lab, Winter Haven, FL
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Shiitake mushrooms could be popping up at roadside stands and farmers markets. A new time- and labor-saving way to grow them may provide an added source of income for small farmers. Instead of drilling 15 to 20 holes in freshly cut oak logs, scientists smear the log ends with a mixture of grain and spawn (the starter culture) and tightly cover each end with aluminum foil. This preserves needed moisture and eliminates contamination by other microorganisms, which could slow down mushroom production. Left outside with all but the ends uncovered, which reduces insect and green mold damage, inoculated logs can produce mushrooms within 2 months and keep producing for up to about 6 years. The valuable and exotic shiitake is second only to the common white button mushroom in annual cultivation worldwide.

Vegetable Lab, Beltsville, MD

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Consumers are closer to getting themselves into a fine pickle--one with about half the salt. That's because Milwaukee-based Chr. Hansen's Laboratory, under an agreement between ARS and Pickles International, has been licensed to grow commercial quantities of two new ARS-developed bacterial strains for fermenting cucumbers. ARS researchers identified, selected and chemically mutated the new strains of *Lactobacillus plantarum* to help prevent pickle bloat. Bloat, caused by pockets of carbon dioxide gas, destroys the crunchiness required for premium pickles, but the new strains don't produce CO₂. To allow the gas to escape, now picklemakers used open-topped tanks. But leaving the top open requires using a lot of salt to prevent contamination by rain water and foreign material. With the new strains, picklemakers could use closed top tanks and less salt.

Food Science Research Lab, Raleigh, NC

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Gardeners can look forward to a new beefsteak tomato—just released to breeders—that is shapely, tasty, extra firm and resistant to several diseases. Many beefsteak tomatoes are prone to cracking and bruising and lack the smooth, globe shape of the new variety. Along with crack and bruise resistance, the yet unnamed tomato resists *Fusarium* and *Verticillium* wilt diseases that afflict tomatoes in the East. Tasters informally rated the new variety at least as flavorful as existing beefsteak types.

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Food Freshness and Safety

A computer-based system could make quick work of beef-carcass grading and relieve much of the tedium and subjective judgments of human graders. With the new system, meat graders would concentrate on verbally describing and measuring carcass characteristics, instead of assessing how well a carcass conforms to standard grading criteria. The new computerized system takes less than 20 seconds per carcass. A voice recognition subsystem "hears" the grader's words. A knowledge-based subsystem compares this information with the official U.S. Meat Grading Standards and awards a grade such as Prime, Choice or Select to the carcass and determines its yield grade. A printout explains the grades given. Another advantage would emerge if and when official standards are changed: The computer could be quickly updated with the new standards without costly, time-consuming retraining of human graders. The system was tested on more than 300 beef carcasses of varying characteristics.

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Chemicals added to feed to prevent caking could also help keep aflatoxin out of cows' milk. Aflatoxin is a natural toxin produced by molds on grain. Scientists found that adding hydrated-sodium calcium aluminosilicate, or HSCAS, to chicken feed tied up the aflatoxin so that it passed harmlessly through the birds' intestinal tract. Since aflatoxin in cattle feed can produce residues in milk, researchers wondered if HSCAS would have the same effect on dairy cows. Federal regulations prohibit more than 0.5 parts per billion (ppb) of aflatoxin in milk. Three dairy cows were given feed containing 100 ppb of aflatoxin plus 1 percent HSCAS. Aflatoxin levels in the milk dropped between 53 and 60 percent for the three cows and fell below the 0.5 ppb upper limit in two of the three.

*Mycotoxin Research Lab , College Station, TX
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Ten newly discovered natural substances might hold the key to removing the bitter taste from navel orange juice and some other winter citrus fruits. These chemicals, which ARS researchers have named "limonoid glucosides," are found in maturing citrus fruit. They are formed from two bitter parent compounds, nomilin and limonin, and contain a glucose sugar molecule . Studies show they are only slightly bitter, as compared to their intensely bitter parents. Boosting production of the glucosides in citrus might eliminate bitterness and increase the market value of navel oranges and several other winter citrus—including some varieties of grapefruit, lemon and tangerine. Bitterness compounds form several hours after navel orange juice is extracted. That means only limited amounts of this juice

can be added to frozen orange juice and other juice products.

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Air heated to 117 degrees F will kill fruit flies trying to piggyback their way into the United States inside freshly picked papaya. Melon, Mediterranean and oriental fruit flies are snuffed out without damaging the taste or texture of other papayas in the shipment. Growers in tropical climates such as Hawaii may be able to use the process to also treat atemoya, mango and other exotic tropical fruits and vegetables to open new export markets. USDA's Animal and Plant Health Inspection Service is now incorporating this treatment into its regulations for papaya shipped from Hawaii. These regulations guard against fruit fly outbreaks on the mainland. Commercially grown papaya is carefully checked before it leaves Hawaii to guard against consumers finding a fruit fly-damaged papaya in the supermarket.

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Second-guessing *Salmonella* is just one of the goals of a computer program being developed by ARS to forecast the growth of food-poisoning bacteria. The program could be used by the nation's food processors to predict how rapidly any one of six bacteria could grow in their products. When the model is finished, processors will be able to type in data about the temperature at which they will process their product, the product's pH, salt and nitrite levels and whether the processing is done with or without oxygen. In return, they'll get a graph that calculates levels for *Listeria monocytogenes* and *Aeromonas hydrophilia*, both of which can grow at refrigerated temperatures; *Salmonella typhimurium* and *Staphylococcus aureus*, the two major causes of food poisoning in the United States; *Clostridium botulinum*, which causes botulism, and *Shigella flexneri*, a pathogen that still poses many unanswered questions for scientists. More organisms may be added to the model in the future.

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